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INTERNATIONAL APPLICATION NO.
PCT/US98/18088INTERNATIONAL FILING DATE
01 April 1998PRIORITY DATE CLAIMED
12 December 1997

TITLE OF INVENTION

MULTI-LINE WIRELESS TELEPHONE SYSTEM COMPUTER INTERFACE

APPLICANT(S) FOR DO/EO/US

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Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ A copy of the International Search Report (PCT/ISA/210).
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☒ Certificate of Mailing by Express Mail
20. ☒ Other items or information:

RETURN RECEIPT POSTCARD

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Applicants : Paul Gothard Knutson et al.
Int'l Appln. No : PCT/US98/18088
Filed : Herewith
For : MULTI-LINE WIRELESS TELEPHONE SYSTEM COMPUTER
INTERFACE

PRELIMINARY AMENDMENT

Honorable Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

In the US national phase application of PCT/US98/18088 filed
herewith, please enter the following amendments:

In the Claims

Please amend the claims as follows:

- In Claim 1, line 1, delete [(100)],
line 2, delete [(120)] and [(120)],
line 3, delete [(121,122)],
line 4, delete [(110)] and [(111,112)],
line 5, delete [(130)],
line 6, delete [(140)],
line 9, delete [(250)] and [(230)].
- In Claim 2, line 2, delete [(241)], [(250)] and [(230)],
line 3, delete [(242)] and [(230)],
line 4, delete [(250)].
- In Claim 3, line 1, delete [(243)].
line 4, delete [(230)] and [(250)].
- In Claim 4, line 2, delete [(230)] and [(250)],
line 3, delete [(115)], [(120)] and [(241,242)],
line 4, delete [(250)], [(120)] and [(250)],
line 5, delete [(251)] and [(120)],

line 6, delete [(115)].

In Claim 5, line 1, delete [(130)] and [(251)],
line 2, delete [(140)].

In Claim 6, line 2, delete [(140)] and [(115)],
line 3, delete [(120)] and [(120)],
line 4, delete [(120)],
line 5, delete [(100)].

In Claim 8, line 1, delete [(140)],
line 2, delete [(100)], [(254)] and (130)].

In Claim 9, line 2, delete [(140)].

In Claim 10, line 1, delete [(110)] and [(100)],
line 2, delete [(120)] and [(111,112)],
line 3, delete [(120,)] and [(121,122)],
line 6, delete [(140)] and [(130)],
line 7, delete [(250)] and [(230)],
line 8, delete [(230)],
line 9, delete [(250)],
line 11, delete [(140)] and (250)].

In Claim 11, line 2, delete [(241)], [(250)] and [(230)],

line 3, delete [(242)] and [(230)],
line 4, delete [(250)].

In Claim 12, line 1, delete [(243)],
line 2, delete [(230)] and (250)].

In Claim 13, line 2, delete [(230)] and [(250)],
line 3, delete [(115)], [(120)] and [(241,242)],
line 4, delete [(250)], [(120)] and [(250)],
line 5, delete [(251)] and [(120)],
line 6, delete [(115)].

In Claim 14, line 1, delete [(130)] and [(251)],

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[illegible]

REMARKS

The above claims have been amended to remove reference indicia. No new matter has been added.

No fee is believed to be incurred by virtue of this amendment. However, if a fee is incurred on the basis of this amendment, please charge such fee against deposit account 07-0832.

Respectfully Submitted,
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MULTI-LINE WIRELESS TELEPHONE SYSTEM COMPUTER INTERFACEBACKGROUND OF THE INVENTION5 Field of the Invention

The present invention relates to multi-line wireless telephone systems and, in particular, to interfacing between a computer and a time-division multiplexed (TDM) wireless telephone system.

Description of the Related Art

10 The use of telephones and telephone systems, including wireless telephone systems, is widespread. In wireless telephone systems, a wireless (cordless) telephone handset unit communicates via either analog or digital modulated radio frequency (RF) signals with a base unit, which is typically connected via one or more standard telephone
15 lines to an external telephone network. In this manner, a user may employ the wireless handset to engage in a telephone call with another, external, user through the base unit and the telephone network.

Multi-line wireless telephone systems are in use in various
20 situations, such as businesses with many telephone users. Such systems employ a handset that communicates with up to N handsets simultaneously, typically with digital communications schemes, such as a spread-spectrum, time division multiple access (TDMA). In a TDMA system, a single RF channel is used, and each handset transmits
25 and receives data during a dedicated time slice or slot within an overall cycle or epoch. It is desirable to provide various features, such as private branch exchange (PBX) features and capabilities, in a multi-line wireless telephone system.

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However, it may be difficult to set up such systems, and to control or access the data within the system. For example, it may be difficult, cumbersome, or impossible to set up or change call routing as desired. This can be especially true in wireless phone systems that do not include sophisticated user interface and user-programmability, and associated peripherals, processors, architecture, and the like. See, e.g., European Pat. App. No. EP-A-0 399 611 (Philips Electronics UK Limited), published 28.11.90, for an exemplary wireless phone system. Such wireless system typically do not contains such features as they are often designed to be relatively inexpensive. These limitations can impair the utility of wireless telephone systems.

Patent Abstracts of Japan, vol. 098, no. 002, 30 January 1998 & JP 09 284380 A (Sony Corp.), 31 October 19979, discloses a telephone terminal, information service device, destination information registration system, and destination information registration method in which a portable telephone sends an acquired telephone number to a base unit, and the base unit sends the received telephone number to a personal computer via a communication interface. European Pat. App. No. EP-A-0 399 611 (Philips Electronics UK Limited), published 28.11.90, discloses a communications system for data transmission over a time-division duplex frequency channel.

SUMMARY

A wireless telephone system comprises one or more wireless handsets and a base unit. Each handset has a handset transceiver. The base unit has a base transceiver for communicating over an RF channel with each handset via its handset transceiver. The base transceiver also includes an interface for interfacing with an external computer, wherein the computer, when interfaced with the base unit via the interface, can control the operation of the wireless telephone system.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of TDMA multi-line wireless telephone system, in accordance with an embodiment of the present invention;

Fig. 2 is a schematic representation of the architecture of the base station of the system of Fig. 1, in accordance with an embodiment of the present invention; and

Fig. 3 is a flow diagram illustrating the data flow of a telephone call combiner operation implemented by the base station of the system of Fig. 1, in accordance with an embodiment of the present invention.

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SUBSTITUTE SHEET

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to Fig. 1, there is shown a block diagram of spread spectrum TDMA multi-line digital wireless telephone system 100, in accordance with an embodiment of the present invention. TDMA system 100 comprises a base unit 110, which has receiver and transmitter units 112 and 111, respectively, and is coupled to external telephone network 116 via telephone line(s) 115. Base unit 110 also comprises interface 130, for providing interfacing between
10 base unit 110 and an external computer such as personal computer (PC) 140.

System 100 also comprises N wireless handsets $120_1, 120_2, \dots, 120_N$. Each has a transmitter and receiver unit (transceiver), such as transmitter 121 and receiver 122 of handset 120_1 . In one
15 embodiment, receiver unit 112 comprises N logical receivers, and transmitter unit 111 comprises N logical transmitters, so that receiver and transmitter units 112 and 111 provide N logical transceiver units, one for each of N wireless handsets. At any given time, M handsets ($0 \leq M \leq N$) are operating or "off hook" (i.e., in the process of conducting
20 a telephone call).

The telephone system provided by system 100 preferably operates in the 900 MHz unlicensed band, and preferably provides features like that of a small PBX, in conjunction with PC 140. In one embodiment, system 100 employs a combination of time division
25 multiplexing (TDM), such as TDMA, and frequency band selection, to overcome interfering sources and to maintain reliable links between the base unit and the handsets. In a digital TDMA scheme, each handset only transmits or receives data during its own "time slice" or slot allocated uniquely to it in the TDMA epoch. System 100 thus

provides a wireless TDM network between the base station 110 and each handset 120_i ($1 \leq i \leq N$).

As explained above, it may be difficult to set up such telephone systems, and to control or access the data within the system. For example, it may be prohibitively expensive to provide programmable configuration abilities into a base unit, or to provide an extensive set of input and output devices beyond the simple numeric keypads of the handsets and base unit. The present invention provides an interface to allow a telephone system, such as the telephone system comprising base unit 110 and handsets 120_i, to be coupled to an external computer, such as PC 140, to facilitate control and use of the telephone system. PC 140 itself is a sophisticated programmable device with adequate input and output devices (e.g., keyboard and mouse, monitor) to allow a user to have a great amount of control over the operations of telephone system 100.

For example, by using PC 140, the user may more easily set up, operate, and control telephone system 100, record data from selected data flows within system 100, route and selectively combine telephone calls and lines, provide various functions such as voice mail (including storage of voice mail messages and caller ID data), conference calling, caller ID functions and caller ID-based call routing and screening, data computational-intensive operations, such as audio or other data compression or decompression, and the like, as described in further detail below with reference to Figs. 2 and 3. In general, the ability of external PC 140 to set up, operate, and control telephone system 100, and to provide the various features and functions described herein, may be referred to as controlling the operation of the wireless telephone system.

In the present invention, the duty to perform certain tasks (e.g., non-real time tasks such as voice mail message storage) is shifted into PC 140 for storage efficiency and to minimize the memory and hardware requirements in telephone system 100. Embedding the various applications performable by PC 140 via interface 130 in base unit 110 would require memory, protocol, and other resources that may be too complex or expensive for a mere telephone system, as such systems are often designed to be relatively inexpensive. The present invention allows a relatively inexpensive digital wireless telephone system to be employed, having only the interface specified herein but not having all of the additional features, components, and functionality necessary to allow for user control of the operation of the telephone system, by providing these features from a PC coupled to the telephone system via the interface, and running relatively inexpensive software applications to provide these capabilities.

Referring now to Fig. 2, there is shown a schematic representation of the interface architecture 200 of the interface 130 of base station 110 of the telephone system of Fig. 1, in accordance with an embodiment of the present invention. Interface architecture 200 allows interfacing between PC 140 and base unit 110, to provide a plurality of useful functions and features, described in further detail below. Architecture 200 comprises transceiver 201 (which comprises transmitter 121 and receiver 122); codec & interfaces 231_1-231_N , one for each of handsets 120_1-120_N ; phone call linear combiner 230, codec & interfaces 210_1-210_N , each coupled to and for one of N external phone lines; voice data buffers 241, 242; control unit 243; embedded computer processor 250; ROM 252; RAM 251; peripherals 255, such as keypad, display, DTMF (dual tone multi-frequency) keys (i.e., keys 0-9, # and *, the symbols used in dialing), lights, and the like; caller ID

interface 253; and external interface 254, which is coupled to an external computer port for coupling to PC 140. External interface 254 may be a standard port such as a RS-232, ethernet, or universal serial bus-compatible interface, sufficient to provide a computer interface port.

Codec & interfaces 231_1-231_N convert linear PCM (pulse code modulated) signals from combiner 230 into compressed format for transmission by transmitter 121 of transceiver 201, and convert compressed signals received from receiver 122 of transceiver 201 back into linear PCM signals to feed to combiner 230. Transceiver 201 takes compressed audio data from codecs 231 encodes this data for protection against RF channel errors, buffers the data until the appropriate time slot for the handset for which the data is destined, and transmits the data, with transmitter 121, at the time slot. Transceiver 201 also receives data from handsets during their respective time slots, decodes channel coding for this data, and transmits compressed data to codecs 231 for decompression.

Phone call linear combiner 230 performs functions such as: routing calls from external phone lines to handsets or to processor 250; providing intercom functions; connecting handsets to the processor to retrieve voicemail; and merging multiple handsets and/or phone lines to make conference calls. Codec & interfaces 210_1-210_N convert analog POTS (plain old telephone service) signal to digital, and may contain a line echo cancellation function. Voice data buffer 241 allows the processor 250 to send voice signals to combiner 230, which may then be routed to one or more handsets, as in the case of voice mail messages. In a multi-handset system such as system 100, multiple messages for several handsets can be conveyed from processor 250 to combiner 230 via buffer 241. Thus, for

example, voice mail messages can be retrieved from RAM 251 or from an external storage device associated with PC 140 via external interface 254. Similarly, voice data buffer 242 allows processor 250 to receive voice signals from combiner 230, such as receiving a message from a phone line and recording it. The recording may be stored in RAM 251, or transmitted across external interface 254 to an external storage device associated with PC 140. Control unit 243 controls combiner 230 and is used to set up combiner 230 to connect calls from phone lines to specified handsets or voice buffers 241, 242.

Embedded computer processor 250 controls system 100, such as transfers of data between interface and RAM 251, and the like. ROM 252 stores the program for processor 250 and all factory setups. RAM 251 stores operating information, temporary variables, and user configurations, and buffers data. RAM 251 may be backed up by a battery. Peripherals 255 handle I/O from base unit 110. For example, peripherals 255 indicate activity to the user (e.g., which lines are in use may be indicated by LEDs), and allow the user to set up the base unit 110 by using the base keypad/display functions of peripherals 255. Caller ID interface 253 may be implemented as an interface to external caller ID modem ICs, or can be an internal modem in hardware or software. Caller ID interface 253 interprets the signals from the call office indicating who originated the call, and makes this information available to processor 250 for indicating on a display of the handset or base, and/or logging in memory 251 or in PC 140 using interface 254. This allows important numbers to be given priority, for example ringing all handsets for high-priority incoming calls, instead of transferring to voice mail if there is no answer on a given handset. External interface 254 allows processor 250 to exchange data with an external computer such as PC 140.

Interface 130 in Fig. 1 is physically represented by external interface 254 of architecture 200, with software support by processor 250 and other functional support provided by the functional elements of architecture 200. Interface 130 thus provides a means for passing various types of data to and from PC 140 via the external computer port and, in particular, provides a means for allowing PC 140 to control and access internal data flows and other aspects of phone system 100. For example, some applications running on PC 140 may be designed to do something with data provided by telephone system 100, such as a voice mail application that can store messages on a storage device of the PC. Such applications need to be able to retrieve from and transmit to system 100 selected audio data. When such an application requires audio data, it needs to be able to read audio data from voice data buffers 241, 242, into the phone call linear combiner 230, and sum data into the ports of the phone call linear combiner 230, which combines and mixes calls. On the other hand, non-audio data transactions, such as those dealing with caller ID messages received from external phone lines, and configuration data used to configure or set up system 100, would not require voice data buffers 241, 242.

Embedded processor 250, in one embodiment, is sufficiently powerful to be able to move data around in real time. For example, processor 250 may provide voice mail by recording a voice message for a missed call, as well as the line number on which the call arrived, and optionally any caller ID data about the call. (For more computational-intensive operations, such as audio compression or decompression, one or more processors of PC 140 may be used to provide a hardware assist to processor 250.) A voice mail function, for example, requires that processor 250 capture audio samples in

real time from voice data buffer 242 (about 8,000 samples/second). These captured samples are then stored in RAM 251 within the system; or externally, in PC 140, via interface 254. Later, when the handset summons (requests) the stored voice mail message, processor
5 250 looks up the message in memory (or receives the data from PC 140 via interface 254), plays it back and presents identifying information (e.g., caller ID information) to the handset.

Voice data buffers 241, 242 serve as the interface between phone call linear combiner 230 and embedded processor
10 250/external interface 254. This allows data to be provided directly to the processor. Phone call linear combiner 230 may be used to combine telephone call data for various purposes, such as conference calling, under the control of PC 140. Thus, architecture 200 provides an interface that allows PC 140 to selectively combine telephone calls.

Interface architecture 200 provides a number of additional
15 features and advantages as well, including storage of call logs in PC 140; voice mail services in PC 140 (e.g., where PC 140 stores an outgoing message as well as all incoming messages); backing up key system parameters, such as caller ID names; and allowing a VIP list
20 which will open lines via caller ID information by VIP users, such as customers.

Interface architecture 200 also provides a means to perform installation/set up/backup functions by PC 140. For example, such a
functionality allows a user to quickly set up the desired features for
25 each handset of the phone system. As an example, a graphical interface on PC 140 may indicate the lines and handsets of system 100, and the human user of PC 140 may set up or configure the system by clicking on various line and handset representations on the screen. The user may indicate which is the main line, and which are

the rollover lines. (The main line receives first calls, and when more than one call comes in, the extra calls come in on a sequence of the other, rollover, lines.) The user may also set up the extension numbers of the handsets, and indicate which handset will be in secretary mode. A secretary phone may be used to display more caller ID information than a normal handset display allows. For example, a secretary computer screen may have a list of caller ID of all lines in the system. The user may also set up the outgoing voice mail messages.

10 A user may also add or delete handsets from telephone system, or add/enable/disable features to the phone system protocols. The present invention also allows the user to back up the configuration of the phone system in preparation for the unlikely event that the current configuration would require restoration, by
15 storing the current configuration data in a storage device of PC 140. Further, the user is enabled to install a system software upgrade through PC 140. PC 140 can be configured to provide to a user, from PC 140, various operational services, such as caller ID name table lookup; call logging; voice mail; VIP services (in which, e.g., if key
20 caller ID numbers come in, make sure they are answered); telemarketing services; and call routing services.

While it is often desirable to set up features in a computer-free mode, the installation application software could simplify the setup process for many users. Plus, given a reasonable bandwidth port,
25 additional features may be added to the system, in alternative embodiments. For example, one could use a bus such as the universal serial bus to connect multiple base stations together, under the control of PC 140, to add functionality such as an increase in overall system size. In this case, an additional digital port is provided, to

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allow for system expansion by allowing base station 110 to interface with multiple other base stations.

The external port coupled to external interface 254 has a bandwidth sufficient to support whichever PC-based features are provided. If PC 140 is used solely for relatively low-bandwidth tasks such as simple initialization and backup of features, an RS-232 port is sufficient. On the other hand, a much higher bandwidth port, such as an Ethernet adapter, is preferably used, for coupling to a local area network (LAN), when two spatially separated base stations are coupled together. Therefore, in one embodiment, a compromise approach is preferable in which a medium bandwidth interface is utilized, such as the universal serial bus (USB), to couple base unit 110 to local PC 140 near the base station. Such a medium bandwidth interface is also sufficient to provide network access or storage and monitoring capabilities, as well as basic setup functions.

Table 1 below shows bandwidth requirements and suitable interfaces for various applications, although those skilled in the art will understand that other suitable interfaces may also be used other than those listed in Table 1.

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Application	Resources	Bandwidth	Interface
Answering Machine	audio, data	>32Kbps/channel	USB, ethernet
Call Logging	data	<1Kbps	USB, RS-232, ethernet
Expansion to additional Base	audio, data	>32Kbps/channel	USB, ethernet
Network Expansion	audio, data	>32Kbps/channel	USB to PC, ethernet
Internet Phone	audio, data	>32Kbps/channel	USB, ethernet
Telemarketing Assistant	audio, data	>32Kbps/channel	USB, ethernet
Software Upgrades	data	~10KBps	USB, RS-232, ethernet
Setup, save and restore features	data	~1Kbps	USB, RS-232, ethernet
Caller ID Table Check	data	~1KBps	USB, RS-232, ethernet

Table 1: Application/Bandwidth Tradeoffs

Referring now to Fig. 3, there is shown a flow diagram illustrating the data flow 300 of a telephone call combiner operation implemented by the base station of the system of Fig. 1, in accordance with an embodiment of the present invention, utilizing phone call linear combiner 230 and under the control of PC 140. Data flow 300 illustrates merging of two audio streams (e.g., two phone calls) for conferencing purposes. Combiner 230 operates on decompressed,

channel from the handsets, to save bandwidth, and thus must be decompressed before being applied to combiner 230. The compressed data may be, for example, in adaptive differential pulse code modulation (ADPCM) format. Thus, for example, an RF signal is received by receiver 121 from a handset, to provide an ADPCM signal, and then decompressed by codec 231, to provide a linear PCM signal. A second signal may be provided, also in compressed form (e.g., to save memory), by processor 250 (or from a processor of PC 140), to the decompression of codec 231 via MUX 301. This may be a signal retrieved from memory, that is to be combined with the handset audio signal, or another handset signal that after being processed by processor 250. Combiner 230 can then combine two or more of the signals from the handset, from processor 250, or from an external telephone line (POTS A/D line, via codec 210). The combined or merged signal is then transmitted out to the appropriate recipients. Alternatively, all audio signals could be transmitted via interface 254 to PC 140, for combining, or for compression and decompression.

One skilled in the art will recognize that the wireless system described above according to the principles of the invention may be a cellular system where base unit 110 represents a base station serving one of the cells in a cellular telephone network.

CLAIMS

1. A wireless telephone system (100), comprising:
- (a) a plurality of wireless handsets (120), each handset (120) comprising a handset transceiver (121, 122); and
 - (b) a base unit (110) comprising a base transceiver (111, 112) for communicating over an RF channel with each handset via its handset transceiver; and an interface (130) for interfacing with an external computer (140), characterized in that said interface comprising: a processor (250), and a phone call linear combiner (230) for selectively combining and routing telephone calls in the system under the control of the processor in accordance with a system configuration, wherein the computer, when interfaced with the base unit via the interface, can communicate with the processor to change the system configuration.
2. The system of claim 1, wherein said interface further comprises a first voice data buffer (241) for receiving voice signals from the processor (250) to be sent to the combiner (230) and a second voice data buffer (242) for receiving voice signals from the combiner (230) to be sent to the processor (250).
3. The system of claim 1, wherein said interface further comprises a control unit (243) for controlling the combiner (230) under the control of the processor (250).
4. The system of claim 1, wherein the selective combining and routing of telephone calls by combiner (230) under the control of the processor (250) comprises at least one of: routing calls from external phone lines (115) to selected handsets (120) or to voice buffers (241, 242) coupled to the processor (250); connecting selected handsets (120) to the processor (250) to retrieve voicemail stored in a RAM (251) of the interface; and merging multiple handsets (120) and/or phone lines (115) to provide conference calls.

5. The system of claim 1, wherein said interface (130) further comprises a RAM (251) for storing system configuration data received from the external computer (140).

6. The system of claim 1, wherein a given system configuration provided via said external computer (140) further specifies at least one of: which external phone line (115) is a main line and which are rollover lines; the extension numbers of each of the handsets (120); which handset (120) is in secretary mode; and which handsets (120) are added or deleted from the telephone system (100).

7. The system of claim 1, wherein the base transceiver establishes a time-division multiple access (TDMA) link over said RF channel with each handset via the handset transceiver in accordance with a TDMA time slot structure allocating exclusive audio packet time slots to each handset.

8. The system of claim 1, wherein the computer (140) further provides one or more features to the system (100), the system further comprising an external port (254) coupled to interface (130), the external port and the interface having a bandwidth sufficient to support the provided features.

9. The system of claim 1, further comprising a second interface for interfacing with a second wireless telephone system, under the control of the external computer (140) to expand overall system size.

10. In a base unit (110) of a wireless telephone system (100) having the base unit and a plurality of wireless handsets (120), the base unit comprising a base transceiver (111, 112), each handset (120) comprising a handset transceiver (121, 122), a method comprising the steps of:

- (a) communicating over an RF channel with each handset via the base transceiver and the handset transceiver;
- (b) interfacing with an external computer (140) via an interface (130) of the base unit; and
- (c) controlling, with a processor (250), a phone call linear combiner (230) of the interface;

- (d) selectively combining and routing telephone calls in the system, with the combiner (230), under the control of the processor (250) in accordance with a system configuration; and
- (e) communicating, with the computer (140), with the processor (250) when interfaced with the base unit via the interface to change the system configuration.

11. The method of claim 10, wherein said interface further comprises a first voice data buffer (241) for receiving voice signals from the processor (250) to be sent to the combiner (230) and a second voice data buffer (242) for receiving voice signals from the combiner (230) to be sent to the processor (250).

12. The method of claim 10, wherein said interface further comprises a control unit (243) for controlling the combiner (230) under the control of the processor (250).

13. The method of claim 10, wherein the selective combining and routing of telephone calls by combiner (230) under the control of the processor (250) comprises at least one of: routing calls from external phone lines (115) to selected handsets (120) or to voice buffers (241, 242) coupled to the processor (250); connecting selected handsets (120) to the processor (250) to retrieve voicemail stored in a RAM (251) of the interface; and merging multiple handsets (120) and/or phone lines (115) to provide conference calls.

14. The method of claim 10, wherein said interface (130) further comprises a RAM (251) for storing system configuration data received from the external computer (140).

15. The method of claim 10, wherein a given system configuration provided via said external computer (140) further specifies at least one of: which external phone line (115) is a main line and which are rollover lines; the extension numbers of each of the handsets (120); which handset (120) is in secretary mode; and which handsets (120) are added or deleted from the telephone system (100).

16. The method of claim 10, wherein step (a) comprises the step of establishing, with the base transceiver, a TDMA link over the RF channel with each handset via the handset transceiver in accordance with a TDMA time slot structure allocating exclusive audio packet time slots to each handset.

17. The method of claim 10, wherein step (c) further comprises the step of providing one or more features to the system, the system further comprising an external port coupled to interface, the external port and the interface having a bandwidth sufficient to support the provided features.

18. The method of claim 10, comprising the further step of interfacing with a second wireless telephone system via a second interface, under the control of the computer (140), to increase the size of the system (100).

19. A base unit (110) of a wireless telephone system (100) comprising the base unit and a plurality of wireless handsets (120), each handset (120) comprising a handset transceiver (121, 122), the base unit (110) comprising:

- (a) a base transceiver (111, 112) for communicating over an RF channel with each handset via its handset transceiver; and
- (b) an interface (130) for interfacing with an external computer (140), characterized in that said interface comprising: a processor (250), and a phone call linear combiner (230) for selectively combining and routing telephone calls in the system under the control of the processor in accordance with a system configuration, wherein the computer, when interfaced with the base unit via the interface, can communicate with the processor to change the system configuration.

20. The base unit of claim 19, wherein said interface further comprises a first voice data buffer (241) for receiving voice signals from the processor (250) to be sent to the combiner (230) and a second voice data buffer (242) for receiving voice signals from the combiner (230) to be sent to the processor (250).

21. The base unit of claim 20, wherein said interface further comprises a control unit (243) for controlling the combiner (230) under the control of the processor (250).

22. The base unit of claim 20, wherein the selective combining and routing telephone calls by combiner (230) under the control of the processor (250) comprises at least one of: routing calls from external phone lines (115) to selected handsets (120) or to voice buffers (241, 242) coupled to the processor (250); connecting selected handsets (120) to the processor (250) to retrieve voicemail stored in a RAM (251) of the interface; and merging multiple handsets (120) and/or phone lines (115) to provide conference calls.

23. The base unit of claim 20, wherein said interface (130) further comprises a RAM (251) for storing system configuration data received from the external computer (140).

24. The base unit of claim 20, wherein a given system configuration provided via said external computer (140) further specifies at least one of: which external phone line (115) is a main line and which are rollover lines; the extension numbers of each of the handsets (120); which handset (120) is in secretary mode; and which handsets (120) are added or deleted from the telephone system (100).

25. The base unit of claim 20, further comprising a second interface for interfacing with a second wireless telephone system, under the control of the computer (140), to expand overall system size.

SUBSTITUTE SHEET

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Table 1. Demographic characteristics of the study population	
Age (years)	65.8 ± 1.2
Gender (male/female)	10/10
Education (years)	12.5 ± 0.5
Occupation (white/blue)	10/10
Marital status (married/divorced/widowed)	10/10/0
Health status (good/fair/poor)	10/10/0
Smoking status (current/former/never)	10/10/0
Alcohol consumption (yes/no)	10/10
Family history of heart disease (yes/no)	10/10
Previous heart disease (yes/no)	10/10
Current heart disease (yes/no)	10/10
Current hypertension (yes/no)	10/10
Current diabetes (yes/no)	10/10
Current cholesterol (yes/no)	10/10
Current blood pressure (yes/no)	10/10
Current heart rate (yes/no)	10/10
Current weight (yes/no)	10/10
Current height (yes/no)	10/10
Current BMI (yes/no)	10/10
Current waist circumference (yes/no)	10/10
Current hip circumference (yes/no)	10/10
Current waist-to-hip ratio (yes/no)	10/10
Current waist-to-height ratio (yes/no)	10/10
Current waist-to-hip ratio squared (yes/no)	10/10
Current waist-to-hip ratio cubed (yes/no)	10/10
Current waist-to-hip ratio to the fourth power (yes/no)	10/10
Current waist-to-hip ratio to the fifth power (yes/no)	10/10
Current waist-to-hip ratio to the sixth power (yes/no)	10/10
Current waist-to-hip ratio to the seventh power (yes/no)	10/10
Current waist-to-hip ratio to the eighth power (yes/no)	10/10
Current waist-to-hip ratio to the ninth power (yes/no)	10/10
Current waist-to-hip ratio to the tenth power (yes/no)	10/10
Current waist-to-hip ratio to the eleventh power (yes/no)	10/10
Current waist-to-hip ratio to the twelfth power (yes/no)	10/10
Current waist-to-hip ratio to the thirteenth power (yes/no)	10/10
Current waist-to-hip ratio to the fourteenth power (yes/no)	10/10
Current waist-to-hip ratio to the fifteenth power (yes/no)	10/10
Current waist-to-hip ratio to the sixteenth power (yes/no)	10/10
Current waist-to-hip ratio to the seventeenth power (yes/no)	10/10
Current waist-to-hip ratio to the eighteenth power (yes/no)	10/10
Current waist-to-hip ratio to the nineteenth power (yes/no)	10/10
Current waist-to-hip ratio to the twentieth power (yes/no)	10/10
Current waist-to-hip ratio to the twenty-first power (yes/no)	10/10
Current waist-to-hip ratio to the twenty-second power (yes/no)	10/10
Current waist-to-hip ratio to the twenty-third power (yes/no)	10/10
Current waist-to-hip ratio to the twenty-fourth power (yes/no)	10/10
Current waist-to-hip ratio to the twenty-fifth power (yes/no)	10/10
Current waist-to-hip ratio to the twenty-sixth power (yes/no)	10/10
Current waist-to-hip ratio to the twenty-seventh power (yes/no)	10/10
Current waist-to-hip ratio to the twenty-eighth power (yes/no)	10/10
Current waist-to-hip ratio to the twenty-ninth power (yes/no)	10/10
Current waist-to-hip ratio to the thirtieth power (yes/no)	10/10
Current waist-to-hip ratio to the thirty-first power (yes/no)	10/10
Current waist-to-hip ratio to the thirty-second power (yes/no)	10/10
Current waist-to-hip ratio to the thirty-third power (yes/no)	10/10
Current waist-to-hip ratio to the thirty-fourth power (yes/no)	10/10
Current waist-to-hip ratio to the thirty-fifth power (yes/no)	10/10
Current waist-to-hip ratio to the thirty-sixth power (yes/no)	10/10
Current waist-to-hip ratio to the thirty-seventh power (yes/no)	10/10
Current waist-to-hip ratio to the thirty-eighth power (yes/no)	10/10
Current waist-to-hip ratio to the thirty-ninth power (yes/no)	10/10
Current waist-to-hip ratio to the fortieth power (yes/no)	10/10
Current waist-to-hip ratio to the forty-first power (yes/no)	10/10
Current waist-to-hip ratio to the forty-second power (yes/no)	10/10
Current waist-to-hip ratio to the forty-third power (yes/no)	10/10
Current waist-to-hip ratio to the forty-fourth power (yes/no)	10/10
Current waist-to-hip ratio to the forty-fifth power (yes/no)	10/10
Current waist-to-hip ratio to the forty-sixth power (yes/no)	10/10
Current waist-to-hip ratio to the forty-seventh power (yes/no)	10/10
Current waist-to-hip ratio to the forty-eighth power (yes/no)	10/10
Current waist-to-hip ratio to the forty-ninth power (yes/no)	10/10
Current waist-to-hip ratio to the fiftieth power (yes/no)	10/10
Current waist-to-hip ratio to the fifty-first power (yes/no)	10/10
Current waist-to-hip ratio to the fifty-second power (yes/no)	10/10
Current waist-to-hip ratio to the fifty-third power (yes/no)	10/10
Current waist-to-hip ratio to the fifty-fourth power (yes/no)	10/10
Current waist-to-hip ratio to the fifty-fifth power (yes/no)	10/10
Current waist-to-hip ratio to the fifty-sixth power (yes/no)	10/10
Current waist-to-hip ratio to the fifty-seventh power (yes/no)	10/10
Current waist-to-hip ratio to the fifty-eighth power (yes/no)	10/10
Current waist-to-hip ratio to the fifty-ninth power (yes/no)	10/10
Current waist-to-hip ratio to the sixtieth power (yes/no)	10/10
Current waist-to-hip ratio to the sixty-first power (yes/no)	10/10
Current waist-to-hip ratio to the sixty-second power (yes/no)	10/10
Current waist-to-hip ratio to the sixty-third power (yes/no)	10/10
Current waist-to-hip ratio to the sixty-fourth power (yes/no)	10/10
Current waist-to-hip ratio to the sixty-fifth power (yes/no)	10/10
Current waist-to-hip ratio to the sixty-sixth power (yes/no)	10/10
Current waist-to-hip ratio to the sixty-seventh power (yes/no)	10/10
Current waist-to-hip ratio to the sixty-eighth power (yes/no)	10/10
Current waist-to-hip ratio to the sixty-ninth power (yes/no)	10/10
Current waist-to-hip ratio to the seventieth power (yes/no)	10/10
Current waist-to-hip ratio to the seventy-first power (yes/no)	10/10
Current waist-to-hip ratio to the seventy-second power (yes/no)	10/10
Current waist-to-hip ratio to the seventy-third power (yes/no)	10/10
Current waist-to-hip ratio to the seventy-fourth power (yes/no)	10/10
Current waist-to-hip ratio to the seventy-fifth power (yes/no)	10/10
Current waist-to-hip ratio to the seventy-sixth power (yes/no)	10/10
Current waist-to-hip ratio to the seventy-seventh power (yes/no)	10/10
Current waist-to-hip ratio to the seventy-eighth power (yes/no)	10/10
Current waist-to-hip ratio to the seventy-ninth power (yes/no)	10/10
Current waist-to-hip ratio to the eightieth power (yes/no)	10/10
Current waist-to-hip ratio to the eighty-first power (yes/no)	10/10
Current waist-to-hip ratio to the eighty-second power (yes/no)	10/10
Current waist-to-hip ratio to the eighty-third power (yes/no)	10/10
Current waist-to-hip ratio to the eighty-fourth power (yes/no)	10/10
Current waist-to-hip ratio to the eighty-fifth power (yes/no)	10/10
Current waist-to-hip ratio to the eighty-sixth power (yes/no)	10/10
Current waist-to-hip ratio to the eighty-seventh power (yes/no)	10/10
Current waist-to-hip ratio to the eighty-eighth power (yes/no)	10/10
Current waist-to	

1/3

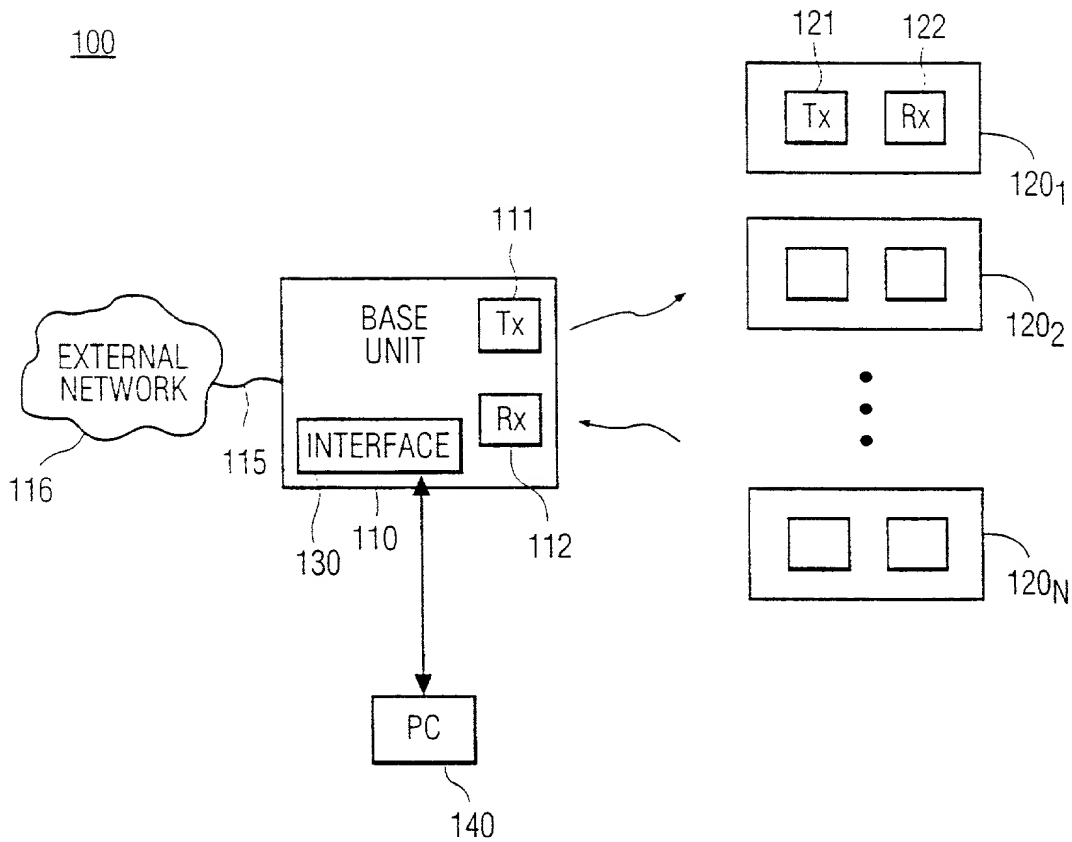


FIG. 1



3/3

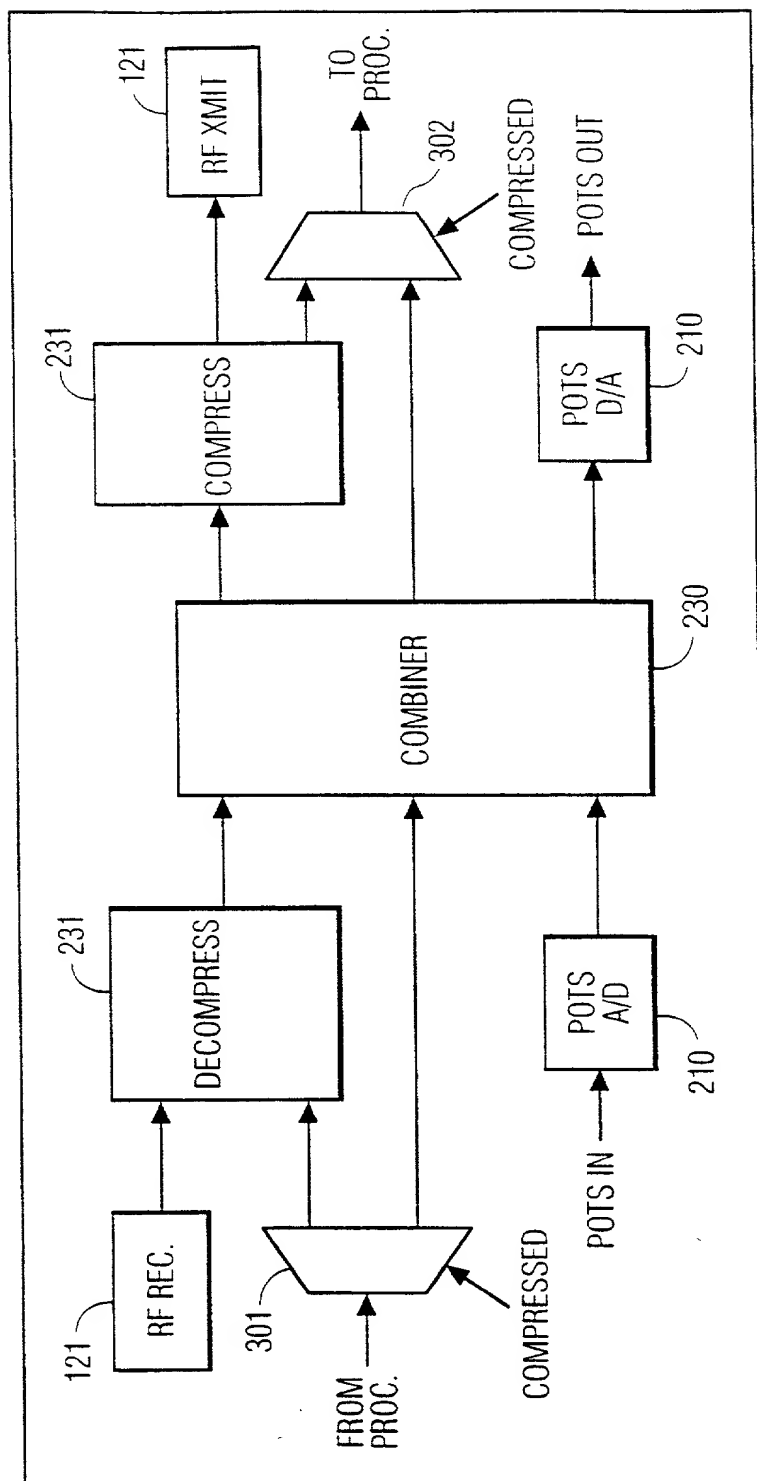


FIG. 3

300

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63) <input type="checkbox"/> Declaration Submitted with Initial Filing OR <input checked="" type="checkbox"/> Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)	Attorney Docket Number	RCA 88795
	First Named Inventor	Paul Gothard Knutson
	COMPLETE IF KNOWN	
	Application Number	
	Filing Date	
	Group Art Unit	
	Examiner Name	

As a below named inventor, I hereby declare

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

MULTI-LINE WIRELESS TELEPHONE SYSTEM COMPUTER INTERFACE

the specification of which *(Title of the Invention)*

☐ is attached hereto
OR
☒ was filed on (MM/DD/YYYY) **September 1, 1998** as United States Application Number or PCT International

Application Number **PCT/US98/18088** and was amended on (MM/DD/YYYY) **February 29, 2000** (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)
60/069,568	December 12, 1997

☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

[Page 1 of 2]

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I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U. S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)
PCT/US98/18088	September 1, 1998	

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

☐ Customer Number
OR
☒ Registered practitioner(s) name/registration number listed below

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Name	Registration Number	Name	Registration Number
JOSEPH S. TRIPOLI	26,040		
JOSEPH J. LAKS	27,914		
FRANK Y. LIAO	40,065		

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto.

Direct all correspondence to: ☐ Customer Number or Bar Code Label OR ☒ Correspondence address below

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Address	PO Box 5312				
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Country	US	Telephone	609-734-9497	Fax	609-734-9700

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle (if any))		Family Name or Surname	
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Inventor's Signature			Date
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		Country	US
Post Office Address	148 South Emerson Avenue		
Post Office Address	Indianapolis, Indiana 46219US		
City		State	
		ZIP	
		Country	

☒ Additional inventors are being named on the 2 supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto

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+

DECLARATION

ADDITIONAL INVENTOR(S)
Supplemental Sheet
Page 1 of 2

Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
Given Name (first and middle [if any])				Family Name or Surname			
KUMAR				RAMASWAMY			
Inventor's Signature	Kumar Ramaswamy			Date	10 th Oct, 2000		
Residence: City	Indianapolis	State	IN	Country	US	Citizenship	IN
Post Office Address	9417 College Drive #B						
Post Office Address	Indianapolis, Indiana 46240 US						
City		State		ZIP		Country	
Name of Additional Joint Inventor, if any:				<input type="checkbox"/> A petition has been filed for this unsigned inventor			
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DAVID FREDERICK				SEEFELDT			
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Residence: City	Lebanon	State	IN	Country	US	Citizenship	US
Post Office Address	501 Henry Street						
Post Office Address	Lebanon, Indiana 46052 US						
City		State		ZIP		Country	
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Given Name (first and middle [if any])				Family Name or Surname			
HARRY VICTOR				STEPHENSON			
Inventor's Signature	Harry Victor Stephenson			Date	10/10/00		
Residence: City	Carmel	State	IN	Country	US	Citizenship	US
Post Office Address	1201 Clay Spring Drive						
Post Office Address	Carmel, Indiana 46032 US						
City		State		ZIP		Country	

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ADDITIONAL INVENTOR(S)
Supplemental Sheet
Page 2 of 2

Name of Additional Joint Inventor, if any:

☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])

Family Name or Surname

ERIC CARL

PETERSON

Inventor's
Signature

Eric Carl Peterson

Date

Residence: City

S. Hamilton
~~Noblesville~~

State

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~~IN~~

Country

US

Citizenship

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State

ZIP

Country

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Given Name (first and middle [if any])

Family Name or Surname

Inventor's
Signature

Date

Residence: City

State

Country

Citizenship

Post Office Address

Post Office Address

City

State

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Country

Name of Additional Joint Inventor, if any:

☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])

Family Name or Surname

Inventor's
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Date

Residence: City

State

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City

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